D 122528 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2025

(CBCSS)

Physics

PHY 2C 07—STATISTICAL MECHANICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

8 *Short questions answerable within* 7.5 *minutes.*
Answer **all** *questions, each question carries weightage* 1.

1. Distinguish between Microstates and Macrostates ?
2. What do you mean by phase space ?
3. What is meant by Canonical Ensemble ?
4. What is meant by ideal gas ?
5. What do you mean by a density matrix ?
6. Define Fermi gas.
7. Outline the features of the Pauli theory of Paramagnetism.
8. What is the significance of chemical potential ?

(8 × 1 = 8 weightage)

Section B

4 *Essay questions, each answerable within* 30 *minutes*
Answer any **two** *questions, each question carries weightage* 5

9. Prove Liouvilles' theorem and explain its physical significance.
10. Explain, the density and energy fluctuations in the Grand Canonical ensemble ?

Turn over

11. Explain Landau's theory of diamagnetism.

12. Explain the thermodynamic behaviour of the ideal Bose system.

(2 × 5 = 10 weightage)

Section C

7 *Problem questions, each answerable within* 15 *minutes*
Answer any **four** *questions, each question carries weightage* 3.

13. Derive the EoS of ideal Fermi gas.

14. Get an expression for the energy fluctuation of the Canonical Ensemble.

15. Show that ideal fermi gas deviates from ideal perfect gas by some factor and also find that factor.

16. Draw the Phase space trajectory of the Harmonic Oscillator.

17. Calculate the Fermi energy in electron volts for Sodium assuming that it has one free electron per atom. Given the density of Sodium is 0.97 g/cm^3, Atomic Weight = 23.

18. Find the average number of photons in an enclosure of 22.4 litres at 273 K ?

19. Find the pressure of black body radiation at 300 K and 6000 K ?

(4 × 3 = 12 weightage)